Disaster Recovery Plan
For Major Business Applications

September 28, 2001

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1 Introduction

1.1 Planning Scope and Assumptions

The scope of this disaster recovery plan will be for five major Bechtel Jacobs Company LLC (BJC) business application systems:

- Payroll, Absence, and Labor System (PALS)
- Oracle Financials
- Cyborg
- Automated Clearing House (ACH) Transmission
- Westcorp

Also included is provisioning for "Thin Client" profile server backup.

The selected disaster recovery site is the 2nd floor vault in building K-1580 at ETTP. Planning scenarios include outages of single servers through the entire loss of the K-1007 machine room and assumes that K-1580 will be fully operational.

This plan includes the following:

- Necessary server re-configurations and K-1580 facilities requirements
- An escalation procedure for declaring a disaster
- Documentation of disaster procedures with staff assignments
- Planning steps to restore normal operation in K-1007 following the disaster
- Estimated time to execute each scenario in the plan

Key assumptions used to develop this plan:

- The BJC data network will be operational
- Key interfaces will be re-established to applications while on K-1580 servers (as determined by functional owners)
- Development and test environments will be implemented in the K-1580 machine room
- Analysis and documentation of functional staff processes will be a follow-on task

Note: Disaster planning for Cyborg is provided based on transitioning the application to the NT platform. The analysis provided in this plan will serve as a roadmap for those implementing the necessary changes starting sometime in 2002.

1.2Plan Execution

Following approval, it will take several months to prepare the K-1580 facility and to move applications to their newly assigned servers. Once these activities are complete, some training of staff will be required, and annual testing of the disaster recovery plans should be performed for business essential applications.

2 Disaster Scenarios

2.1 Description of each scenario

This plan includes two disaster scenarios:

- The loss of a single server supporting one of the applications covered by this plan
- The loss of the entire K-1007 machine room

2.2 Risk assessment for each scenario

The following table contains possible disaster situations that could result in one of the two disaster scenarios.

Table 1 - Scenario Risk Assessment

Disaster Events	Scenario	Risk Category
Hardware Failure	Restricted to a single server	Anticipated
System Software Failure	Restricted to a single server	Anticipated
Air Conditioning Failure	Entire machine room in K-1007	Anticipated
Power Failure	Entire machine room in K-1007	Anticipated
Water Entry	Entire machine room in K-1007	Anticipated
Fire and Smoke	Entire machine room in K-1007	Anticipated
Natural Disasters (Tornado, Flood, Earthquake, etc.)	Entire machine room in K-1007	Unlikely
Riots and Civil Disorders	Entire machine room in K-1007	Unlikely
Sabotage	Entire machine room in K-1007	Unlikely

Risk Categories

1. Anticipated – $10^{-1} \square p \square 10^{-2}$ Incidents that may occur several times during the lifetime of the facility. (Incidents that commonly occur)
2. Unlikely – $10^{-2} \square p \square 10^{-4}$ Accidents are not expected to occur during the lifetime of the facility.

(DOE-STD-3009-94, Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports : 5)

3 Declaring a disaster

3.1BJC disaster team

Based on information received from technical or functional staff, a disaster situation would be declared by Ruth Boys, Manager of Applications and Databases. Ruth's decision will be supported by the following application functional contacts.

Table 2 - BJC Disaster Team

Application System	Emergency Coordinators

3.2 Description of process for declaring a disaster

Ruth Boys will declare a disaster and notify Computer Operations. Computer Operations will in turn reference the Call List maintained at the computer operations center and forward the declaration notice to the Emergency Coordinators and the appropriate technical team members.

It is recommended that an electronic copy of the Disaster Recovery Plan be maintained on a shared network disk drive. A hardcopy of the document should be maintained for use on site with additional hard copies for each of the Emergency Coordinators.

4 Disaster Recovery Strategy Utilizing K-1580

4.1Current K-1580 Usage

The disaster recovery strategy contained in this plan is based on the assumption that development/test environments will be established in K-1580 for all applications.

Currently the following computers are located at building K-1580:

- Westcorp Computer, monitor and laser printer
- BJCUCAMSDEVDB Computer, monitor, disk tower, TZ88 tape drive and an uninterruptible power supply (UPS) (UCAMS development database server)
- BJCDNS2 Computer, monitor and a shared UPS (Name server)
- BJCPRN1580 Computer, monitor and a shared UPS (Print server)
- MCIS9 Computer, monitor, disk array, 2 DLT 4700 tape drives and a UPS
- BJCPROD1 Computer, disk array, monitor, 2 tape drives and a UPS

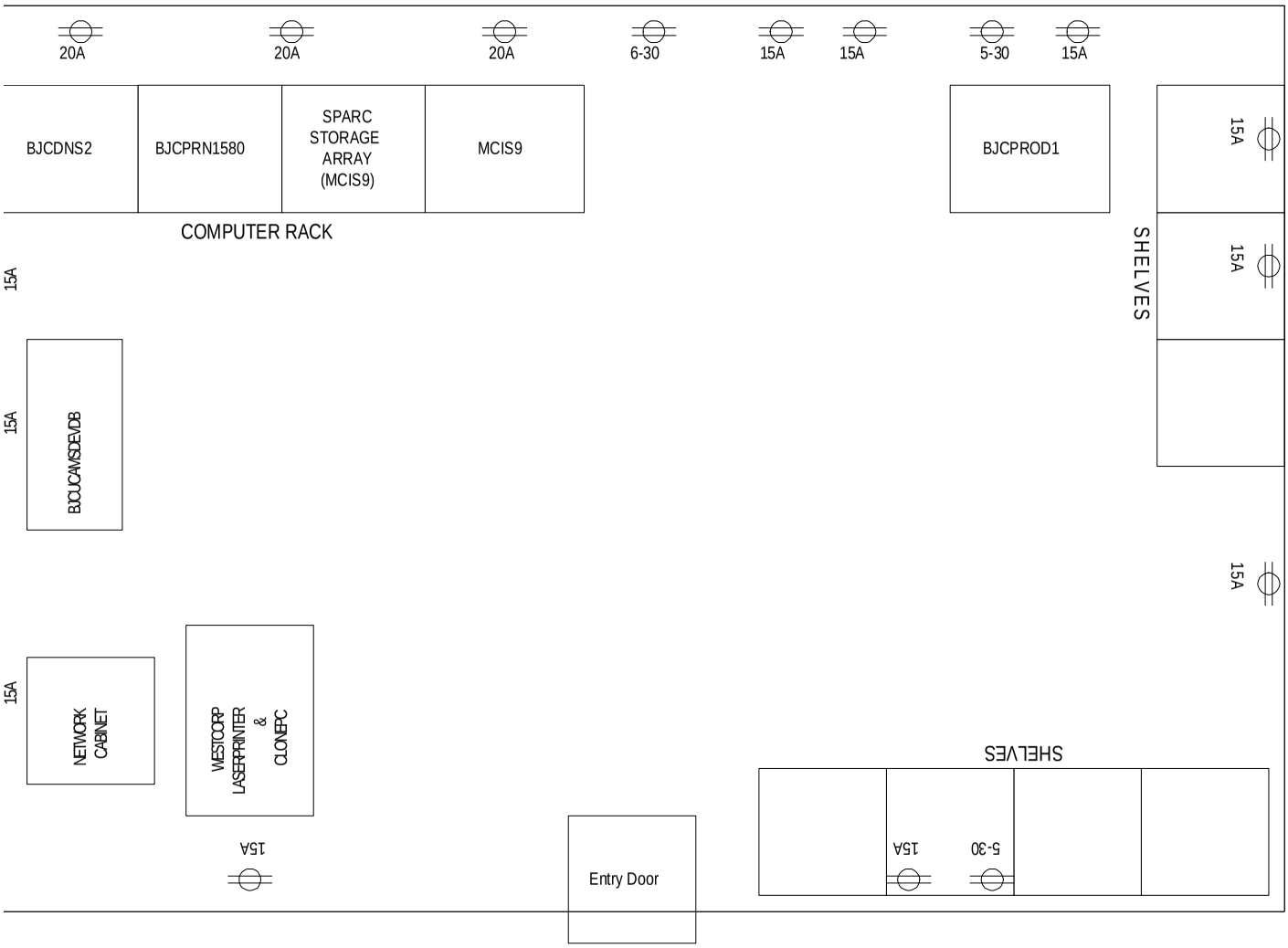
The following network connections exist at K-1580:

- Network cabinet containing sensitive and non-sensitive connections

4.2 Current K-1580 disaster recovery facility layout

Figure 1 shows the current layout of the facility to support the business systems included in this disaster recovery plan.

SERVER LAYOUT FOR BUILDING K1580
August 20, 2001



The vault in K-1580 was not designed to support a computer operations center and several changes will be required to ready the room as a backup facility (See Section 4.5). These changes include pulling additional power into the room, changing notification procedures anytime support utilities will disable the room, and required changes to the security system to meet BJC security requirements for computer facilities.

Current utilities and conditions at the backup facility include:

- Two separate air conditioning (A/C) units provide cooling to the backup facility but they are supplied by one chilled water source. Air conditioning appears likely to be adequate to accommodate the additional equipment required in this plan.
- Sprinkler system – heat activated
- Limited access - There is only one doorway into the K-1580 disaster recovery room.
- Security system - Access into building K-1580 disaster recovery room is administratively controlled by a Hirsh badge reader. Personnel who are not authorized for access and whose names are not in the badge reader system must sign the visitor's log.
- Notification - BJC management and SAIC support personnel were added to the building K-1580 planned outages notification list.

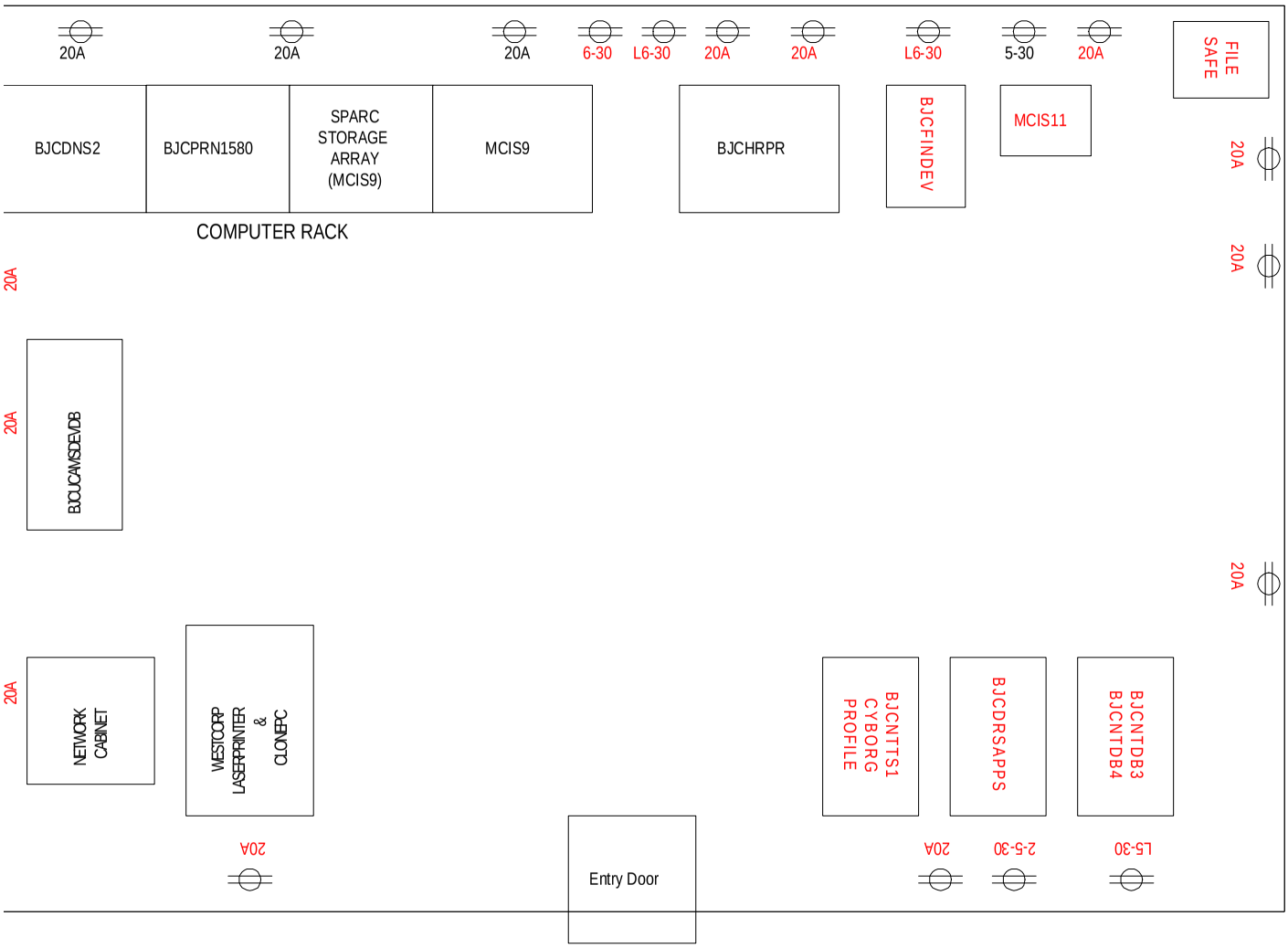
Because of the limited space available in the backup facility, there is not sufficient room to add additional servers or other computing support hardware in this room.

4.3 Future K-1580 disaster recovery facility layout

Figure 2 shows the recommended layout of the facility to support the business systems included in this disaster recovery plan.

SERVER LAYOUT FOR BUILDING K1580

- Future -



4.4 Current and Planned Server Assignments to Support the Disaster Recovery Plan

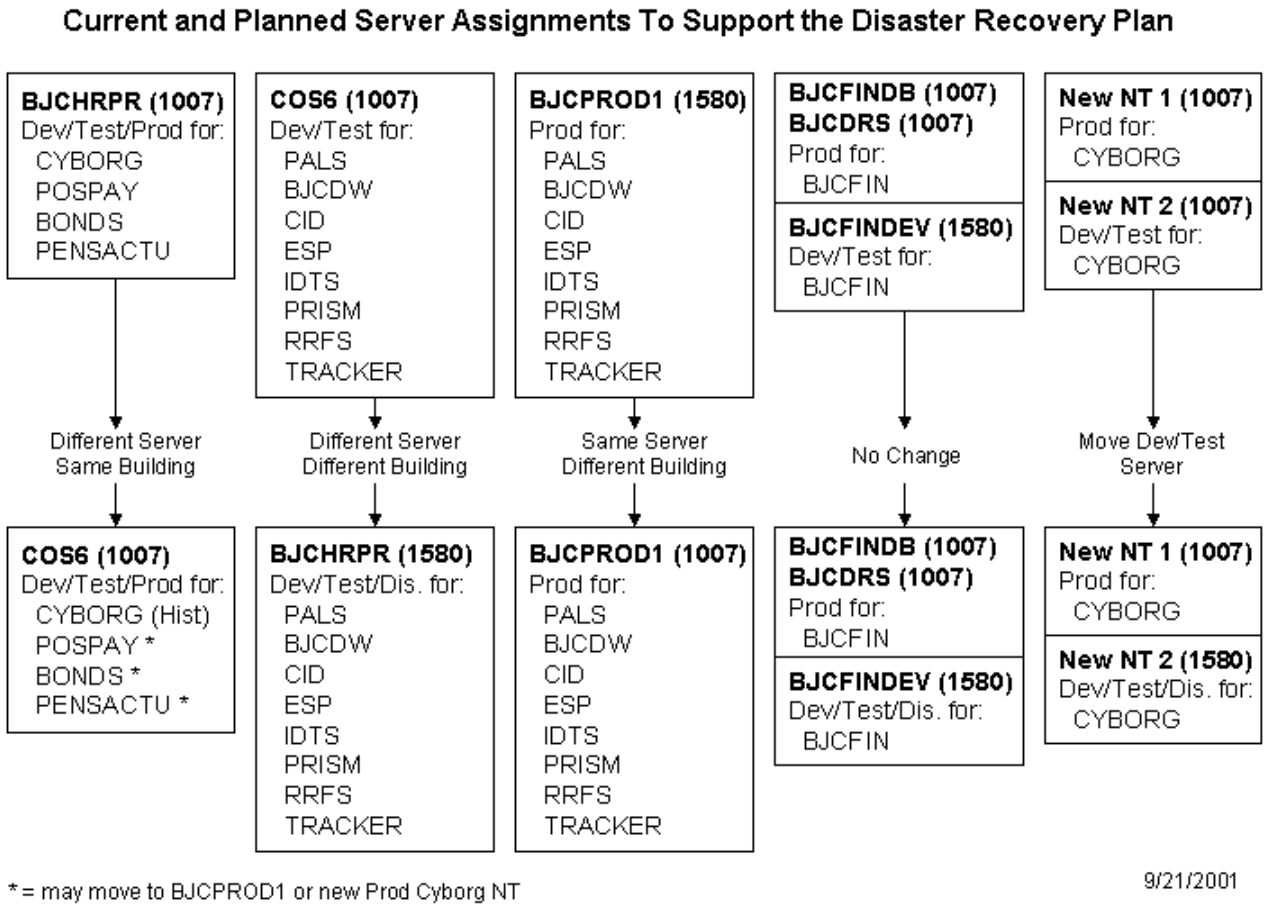


Figure 3 - Current and Planned Server Assignments To Support the Disaster Recovery Plan

4.5 Recommendations for K-1580 infrastructure upgrades, including cost and schedule requirements

The following actions are highly recommended to accommodate the additional hardware planned for this room:

- Install smoke alarms.
- Install a water detection system with alarms to the PSS office.
- Upgrade electrical to accommodate equipment with L5 30R and L6 30R plug configurations.

5 Disaster plan for PALS

5.1 Describe production requirements

This overview describes the hardware and software components needed for a successful PALS production cycle. The sub-sections address the storage, software, and hardware requirements in more detail. The PALS application requires the following processes to take place each week:

- Employees enter their own or others' payroll, absence, and labor charges on PC's either with a C client program located on the PC or through a Java applet accessed through the BJC intranet (WebPALS).
- The data entry function communicates with the PALS application server residing on BJCPROD1. In the case of the C client, the client communicates via TCP/IP directly to the application server. The WebPALS applet is served up from web server BJCWEB1. Transactions from the applet communicate to the BJCPROD1 application server via a URL connection to a CGI program that resides on BJCWEB1.
- PALS operates on a weekly cycle with normal closeout on Monday mornings at 10 A.M. The closeout consists of batch scripts and executables on the BJCPROD1 server.
- BJCPROD1 hosts both the PALS application server and the database server (currently Oracle 7.3.4 with plans to move to Oracle 8i in FY02).
- Additional components of PALS are two functions written in ColdFusion (CF). The CF scripts are hosted on BJCWEB2 and the ColdFusion server communicates with the PALS database.
  - The Internal Access List (IAL) function maintains the assignment of functional roles in PALS
  - The Absence Inquiry function enables employees to view their absences and remaining eligibility.

5.1.1 Storage requirements and database backup processing

The database storage requirement for PALS on BJCPROD1 is currently approximately 7.5 GB. PALS contains all historical transactions since it went into production at BJC's inception in April 1998. PALS could run without the bulk of the past data if there were a mechanism to easily exclude it. If BJC has purchased or does purchase Oracle 8i's partitioning option, the historical data could be left offline during recovery operations. This plan assumes a backup machine that is identical in storage to the production machine; therefore partitioning is not an active part of this plan.

Database backup processing consists of a monthly (second Friday) cold backup. Hot backups are performed nightly. Also, exports of the database tables are completed nightly. Transaction logs are also maintained. In theory, if the hot backups and transaction logs are available, the database can be restored up to (or very near) the point of the failure.

The hot backups are completed nightly between 3:00 and 4:00 A.M. These backups and transaction log files are copied to tape as part of the incremental system backup that runs daily starting at 4:00 P.M. If the disk(s) containing the hot backups and transaction logs are lost prior

5.1.2 Software requirements and configuration control processing

Listed below are the current software requirements by processor for the PALS application:

- BJCPROD1: Digital Unix 4.0D, Oracle 7.3.4
- BJCWEB1: Digital Unix 4.0D, Apache Web Server
- BJCWEB2: Windows NT 4.0 SP5, Cold Fusion Server (currently upgrading to 5.0)

Configuration control processing for the PALS application is managed in the following ways:

- Each configuration item (executable and related source and/or shell script) is maintained in its own directory under the configuration control directory.
- There is a sub-directory containing source for each release.

Software is developed and tested on the development machine (currently COS6). When ready for production, the source is moved to BJCPROD1 where it is recompiled. To facilitate disaster recovery a proposal may be submitted to the "backup production" area on the development machine. As new items are moved to BJCPROD1 for production, they will also be placed in the development "backup production" area on the development machine to keep it synchronized with production.

5.1.3 Hardware architecture

PALS utilizes the following processors:

- BJCPROD1, Compaq (DEC) Alpha 4100.
- BJCWEB1, Compaq (DEC) Alpha 255.
- BJCWEB2, HP PC, model D484A.

5.1.4 Interface requirements

PALS receives input from the following application systems:

- **Oracle Financials -** Twice daily a batch job copies the charge code lookup table from Oracle Financials (via a database link) into a PALS local table.
- **Employee and non-employee data from the shared EMP repository on BJCPROD1 (derived from Cyborg) and the GLI-NES database -** EMP provides information on employees and GLI-NES provides non-employee data as well as some additional employee data (e.g., preferred name). Updated information from these sources is pulled into PALS via database links in batch jobs that run daily at 4:30 A.M. Thursday through Monday. At the end of the closeout process on Monday, the PALS employee tables are totally refreshed from these two sources.
- **UCAMS -** Once a day a batch job refreshes a local PALS table with a complete list of user id's and associated badge numbers from the UCAMS application system. The input for this job is a file received by PALS via network transfer from UCAMS.
- **Cyborg -** On Monday evening, Cyborg produces a file that is placed in a PALS directory on BJCPROD1 containing updated absence eligibility information after the previous week's Paid Time Off and Vacation deductions from PALS have been processed and the new Paid Time Off and Vacation accruals are generated by Cyborg.

- **Service Centers -** The service centers pull charge information from PALS once a month immediately after the business month end closeout in PALS.

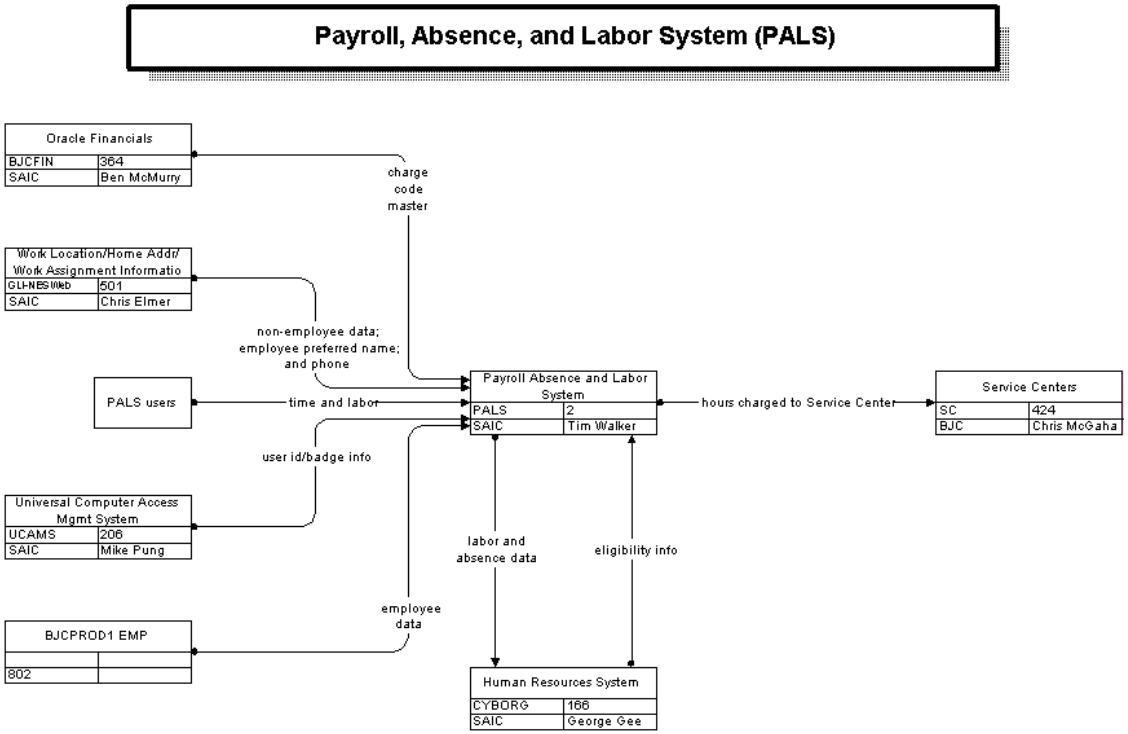


Figure 4 - PALS Interfaces

5.2 Describe business processing requirements

Business processing of Payroll, Absence, and Labor, requires that PALS operate on a weekly cycle. Closeout normally starts about 10 A.M. on Monday. When holidays alter bank-processing deadlines for ACH transactions, the PALS closeout processing is sometimes done a day or two early (over the weekend). After the closeout, a new cycle starts.

Time entry is made daily by individual employees or by group data input. Data for future periods can be entered in prior periods. After user input is complete for the week, the appropriate supervisors (there may be multiple levels of approval) approve the time.

When all time is approved, closeout for the prior week starts. Some time records may be presented to Payroll Services for manual review and closeout. When all employees are closed, final batch programs run. After closeout completes, the cycle repeats itself.

Successful PALS processing must occur for downstream processing of payroll, attendance, and labor. If PALS cannot provide the downstream application systems with input, the payroll application system (Cyborg) must use an alternate method to provide employees with a payroll check, see Section 5.3. Whatever option Cyborg uses, it will be "invisible" to PALS since the payment to the employee will be considered as an advance rather than a payment for actual payroll hours.

The timing of a disaster within the weekly cycle will affect the recovery mechanism. The best time for a failure is immediately after a closeout, because there is a 7-day window before the next closeout must occur. A disaster on Monday morning prior to or during closeout presents the most difficult problem. The time available to bring up the recovery machine, to do final time entry and approval, and to complete the closeout is limited by the maximum start time for Cyborg to meet its downstream deadlines. However, with a Tuesday or Wednesday disaster, there is a multiple day window open for bringing up the recovery system.

5.3 Describe disaster mitigation strategies

The assumption of this plan is that a machine identical to production, BJCHRPR, is to be used for recovery and that the standard network connections for this machine exist. However, PALS could operate with fewer resources.

It is the desire of the CFO staff to run PALS if at all possible. If it is determined that PALS cannot be restored on the backup machine in time for PALS manual processing (time entry, approvals) and closeout to occur before Cyborg's maximum start time to meet its downstream deadlines, Cyborg will produce its' output without simulating PALS input. For example, Cyborg may do a "net pay" run. This alternative should be "invisible" to PALS. The net pay is an advance within Cyborg that is reversed out of the next normal paycheck.

There are some preparations that could simplify the recovery process although none of these is mandatory for a successful disaster recovery:

- Change the URL for WebPALS from www.bechteljacobs.org (normally refers to BJCWEB1) to an alias such as pals.bechteljacobs.org. If WebPALS moves to BJCDEVWEB during a disaster and there is no alias, users must be informed to access www-dev.bechteljacobs.org. If users always use the alias, network support can re-route to the backup server during a disaster. For SSL (https) support, there is a $249 annual charge for the alias. Also, networking will have to re-establish both bjcweb1 and bjcdevweb's httpd.conf to do name-based hosting or IP-based hosting.
- When moving to the recovery machine, the PALS production directories must contain the current production executables and scripts. Restoration of the PALS production areas from the last production machine backup is one possibility. However, keeping an up-to-date production area on the backup machine as part of the standard configuration control process would eliminate this step in the recovery process.
- To simplify restoration of the database to the recovery machine, the Unix file system naming structure on the recovery machine should be made to mirror the production machine.
- Another strategy to shorten the recovery time would be to have a second copy of the hot backups and transaction logs written from the production server to the backup server. This should be possible once Oracle 8i is in production. A variation on this that could be implemented prior to Oracle 8i is the addition of procedures to copy the files from the production machine to the backup machine in the alternate location. This would lessen the dependency on the timing of the incremental backups to tape and lessen the need to find and transport the tape to the backup facility.

5.4 Describe minimal network, storage, hardware, software and interface requirements for each disaster scenario

5.4.1 Network

It is mandatory that PALS be on the network in order for employees to enter their time via the C and WebPALS clients. However, there is no need to have network connections to other processors since there are alternatives outlined later for processing PALS without connections to interfacing systems. There must be a means of moving the PALS Cyborg file to the Cyborg Production or Recovery machine, but this could be done manually (e.g., via tape) if there is no network connection.

5.4.2 Storage

Sufficient disk space is required to support the PALS database (currently 7.5 GB). Once PALS moves to Oracle 8i, it would be possible to leave historical transactions offline and use considerably less disk space. This capability requires the Partitioning Option of Oracle 8i to have been purchased or a method to restore the full database somewhere temporarily, deletion of the historical data, and then movement of the "trimmed" database to the PALS recovery machine.

5.4.3 Hardware

An alpha processor is required, but a lesser processor could be used. For example, development has been on COSDEVD, a 2100 Alpha, until recently. This processor would suffice for PALS processing during a disaster period.

5.4.4 Software

The current software (operating system and utilities, Oracle database) on the PALS production or development machines would be required.

5.4.5 Interfaces

PALS can operate without its interfaces. Alternatives to the interfaces are:

- If Oracle Financials is unavailable, CFO will communicate new/changed charge number information to the PALS support team who will update the charge_code_master table in PALS.
- If the EMP repository and/or GLI-NES are unavailable, new employees must be setup manually in PALS by Payroll Services. There is an Update Personnel Data function in PALS to accomplish this.
- If UCAMS is unavailable, new accounts must be setup manually in Oracle by DB Support. In PALS, the support team would enter new UID's and associated badge numbers directly into the userid table.
- The input interface to PALS from Cyborg is the updated absence eligibility information. If this information were unavailable from Cyborg, PALS would operate with out-of-date eligibility information. Overrides can be made manually if necessary. For example, if an employee fails to receive a PTO accrual necessary to cover PTO to be taken in the next week, either the PTO balance will be overridden or the employee can enter borrowed PTO.
- Output to Cyborg (assuming Cyborg is operating during the disaster) can be accomplished manually (e.g., transfer of tape) if the network connection is not operational.

5.5Describe K-1580 upgrades needed to support disaster-related PALS processing

Currently PALS production is on BJCPROD1, which resides in K-1580. The current development machine, COS6, will not support Oracle 8i and therefore is not the long-term solution. Plans are for BJCHRPR to become the PALS development machine after Cyborg moves its primary production to Windows NT. BJCHRPR is identical to BJCPROD1 in terms of processor, memory, and disk configuration.

Cyborg must retain its Unix database and some software for historical purposes, although this may move to another processor. Also, there are other applications on BJCPROD1 and BJCHRPR that must be considered. Depending upon the planned deployment of these applications, some upgrades to BJCPROD1 and BJCHRPR might be required.

BJCHRPR will be implemented as the PALS development/backup machine. BJCPROD1 will be retained as the production system and will be physically moved to K-1007. BJCHRPR will be

The assumption is that BJCPROD1 and BJCHRPR are equivalent machines unless the production system is enhanced to support more applications in production than the backup machine will need to support during a disaster.

When BJCHRPR is brought online as the PALS development machine, it should be configured to be as much like BJCPROD1 as possible. For example, the same Unix file system and RAID configuration should be implemented.

The development and production machines will be synchronized in terms of the Unix and Oracle versions. The only time this will not be the case is during an upgrade period. Typically the development machine is upgraded for a short test period before the change is made in production. If there were to be a disaster during this period, it might be necessary to restore the production machine's full image to the development machine or revert to the prior version of Unix and/or Oracle in order to bring up the production application on the backup machine.

The other processor that PALS depends upon is BJCWEB1. Its backup will be the development processor, BJCDEVWEB, which will be re-located to K-1580. No upgrades to BJCDEVWEB should be required for it to support WebPALS; if it must support other web applications, it may require more resources.

5.6Describe process to re-host application in K-1580 and resume processing

5.6.1 Lose BJCWEB1

A loss of BJCWEB1 will require diverting WebPALS requests to BJCDEVWEB. The process to substitute BJCDEVWEB for BJCWEB1 requires two steps:

- CGI program on BJCDEVWEB must be changed to direct WebPALS TCP/IP requests to the appropriate production machine and port. Recompile the program (or keep an executable in reserve) to communicate with the production (not development) server. Note that this step is not required if both BJCWEB1 and BJCPROD1 are lost since BJCDEVWEB communicates with BJCHRPR in its normal state.

- Users must be re-directed to BJCDEVWEB. If an alias such as pals.bechteljacobs.org is used, networking will change this alias to point to BJCDEVWEB and this should be transparent to users. Otherwise, emails should go out to users to re-direct their WebPALS requests from www.bechteljacobs.org to www-dev.bechteljacobs.org.

5.6.2 Lose BJCPROD1

A loss of BJCPROD1 will require restoring the production environment on BJCHRPR. The process to re-host PALS on the development/backup machine BJCHRPR requires six steps:

1. Determine whether a backup of the development machine is required before the restoration

backups may suffice for development restoration at the end of the disaster or the development area may remain undisturbed during the restoration process.

2. Determine if any of the operating system software or database software must be restored. If this software is being upgraded on development, it might be necessary to restore the production machine's full image to the development machine or revert to the prior version of Unix and/or Oracle in order to bring up the production application on the backup machine.

3. Restore the database, which consists of three steps.
   - Locate the backup tapes and transport to the recovery site.
   - Restore backup files from tape to disk area.
   - Perform database restore from database backup files and transaction logs.

4. Verify that a copy of the PALS production environment (executables and scripts) exists and is up-to-date on the backup machine. As has been suggested earlier, once this plan goes into place a standard part of configuration management should be to keep a "production" area ready to go on the development machine as the items are changed on the actual production machine. If there is any doubt as to the status of this area, restoration of the production area from the standard backup tapes of the production machine should be evaluated.

5. The CGI program on BJCWEB1 (or BJCDEVWEB) must be changed to direct WebPALS requests to BJCHRPR. Note that in the case of losing both BJCWEB1 and BJCPROD1 (e.g., losing K-1007), only the port number must be changed [development port differs from production port], but not the IP address, since BJCDEVWEB normally communicates with BJCHRPR in the development environment.

6. If the C client is still in use (current development plans call for its retirement in FY02), the alias it uses to access PALS must be altered by Network Support to point to the recovery machine.

5.6.3 Lose K-1007 Machine Room

A loss of the K-1007 machine room implies both of these processors are unavailable; therefore both of the procedures described above must be undertaken.

5.7Describe process to return application processing to K-1007 following the disaster

Restoration of PALS on the production machine in K-1007 after a disaster depends upon how the disaster was handled. There are three possible situations:

1. A Cyborg-only strategy was used that is invisible to PALS. This would be the case if PALS died too late to restore for the current week, but is up and running on production the next week; a recovery PALS is never brought up. However, the incomplete PALS week must be closed out and the actual payroll data sent to Cyborg.
2. PALS was brought up on the recovery machine and run completely on the recovery machine for one or more weeks before being restored to the production machine.
3. A combination of the first two may apply. For example:
   - PALS is lost at 10 A.M. on Monday just before closeout starts and the decision is made that Cyborg will do a net pay run. No PALS processing is completed for the week.
   - It will be a week (or more) before K-1007 can be restored requiring PALS to be moved to the backup machine for the second week of processing during the disaster. When

If PALS has been moved to the backup machine and some processing performed, then a restoration to the original production machine is required when the production machine is available again. We assume that everything on the production machine has been restored from backups (Operating System, Oracle software, PALS executables and scripts) with the exception of the database.

At the appropriate time, a move from the backup machine to the production machine will be performed. PALS will be shut down and the database on the recovery machine backed up. Then a restore will be performed on the production machine. Once everything checks out OK, PALS can be brought back up on the production machine.

While the database is being restored on the production machine and PALS is down, the process to re-configure BJCWEB1 should take place. It is the opposite of the procedures described earlier. The CGI must be changed to refer to BJCPROD1 rather than BJCHRPR. Also, the users must be informed to revert to www.bechteljacobs.org unless the alias is in use, in which case network support must change the alias to point to BJCWEB1.

5.8Describe effort requirements for each disaster scenario

5.8.1 Lose BJCWEB1 and not BJCPROD1

Cost and time involved here is minimal. Application programmers can configure BJCDEVWEB to access BJCPROD1 within an hour. If we switch to the use of an alias for the URL, then network support will have to make appropriate changes to point the alias to BJCDEVWEB. Otherwise, users must be notified to use a different URL.

5.8.2 Lose BJCPROD1 and not BJCWEB1

Costs involved are additional labor hours required from systems, network, and database support groups to restore the production environment on the recovery machine. Likewise, there will be similar costs involved in restoring the database to K-1007 after the disaster.

As a rough estimate of the schedule for doing the restore, referring to the steps outlined in section 5.6 (some of these may be carried out in parallel):

1. If a backup of the development machine is required, a tape backup of the development areas and exports of the Oracle tables should be sufficient. Estimate: 1 hour.
2. [Rare] If the production and development machines are out of sync at the operating system (OS) or database levels, the backup machine must be brought up to production standards.
3. Restore the database by performing the following steps:
   - Locate tapes and transport to recovery site. Estimate: 1 hour.
   - Restore hot backup and transaction logs to disk. Estimate: Less than 2 hours. (Recent incremental back-up of entire system took 2 1/2 hours)
   - Restore database: Estimate: 2 to 3 hours this too would vary depending on number of transactions to be re-applied.

6. Network support changes alias (URL, if applicable, and/or alias used by C client). Estimate: 2 hours (in parallel).

In summary, if no changes to the Operating System or Oracle software are required, 8 hours should be ample time to restore the production database to the backup machine.

Failures from noon on Monday (after closeout) through the weekend should not present a time problem. The latest date to get PALS up and running is early the following Tuesday morning, so the maximum recovery window will be measured in days.

The smallest window for recovery is a failure late on Monday morning just prior to successful completion of closeout and transfer of the PALS file to Cyborg. If the restoration procedure begins by noon Monday, PALS should be available, assuming a maximum 8-hour recovery period, at the latest by 8 P.M. Monday, with another 10 hours potential recovery time for the out of the ordinary situations; this would push PALS availability to 6 A.M. Tuesday morning. This gives anywhere from a 6 to16-hour window on Monday evening and Tuesday morning to complete data entry and approvals (Monday, and possibly weekend and Friday data entry might have to be redone) and to do the closeout.

5.8.3 Lose all of the K-1007 Machine Room

This is the same as 5.8.2 and 5.8.3 combined.

6 Disaster plan for Oracle Financials

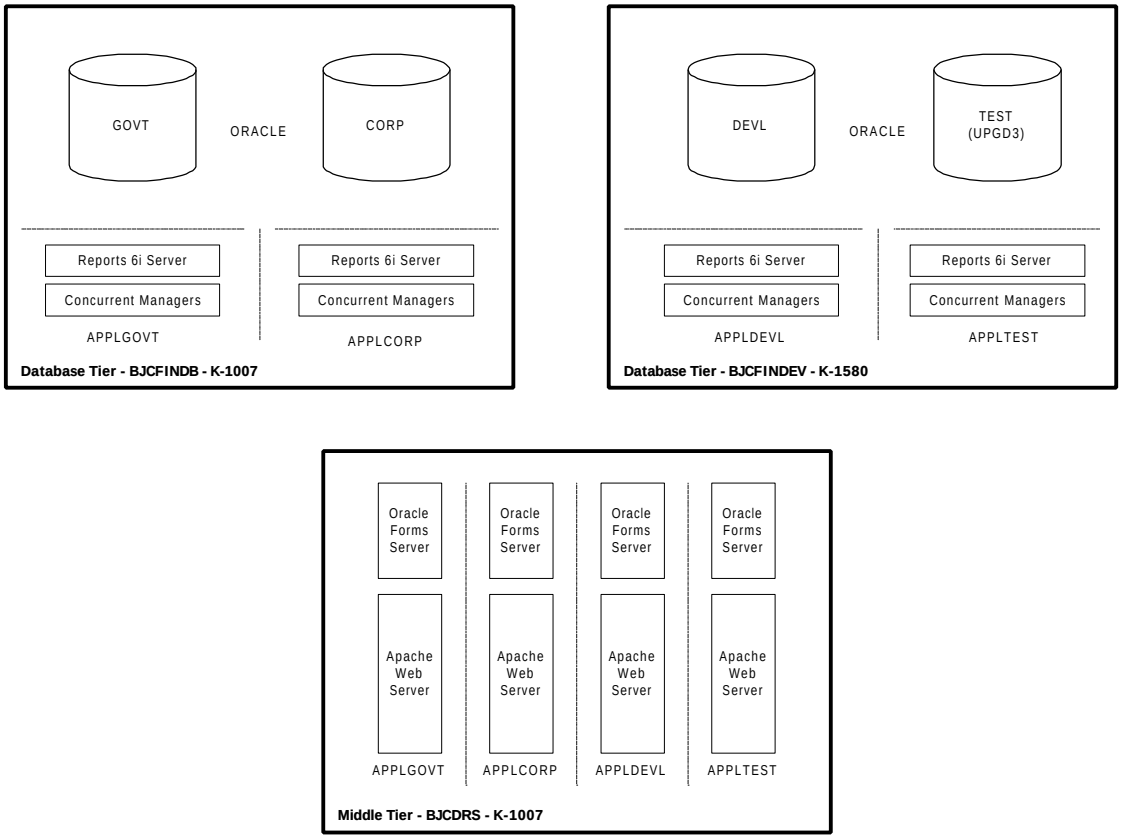
6.1 Describe production requirements

Users access the application on the Web using Netscape or Internet Explorer. Users access the database through Microsoft Access or Oracle Discoverer using ODBC or Net 8. The ability to receive inputs from and send outputs to several other application systems is achieved by using a shared "P drive". An Oracle registered printer is used for producing output.

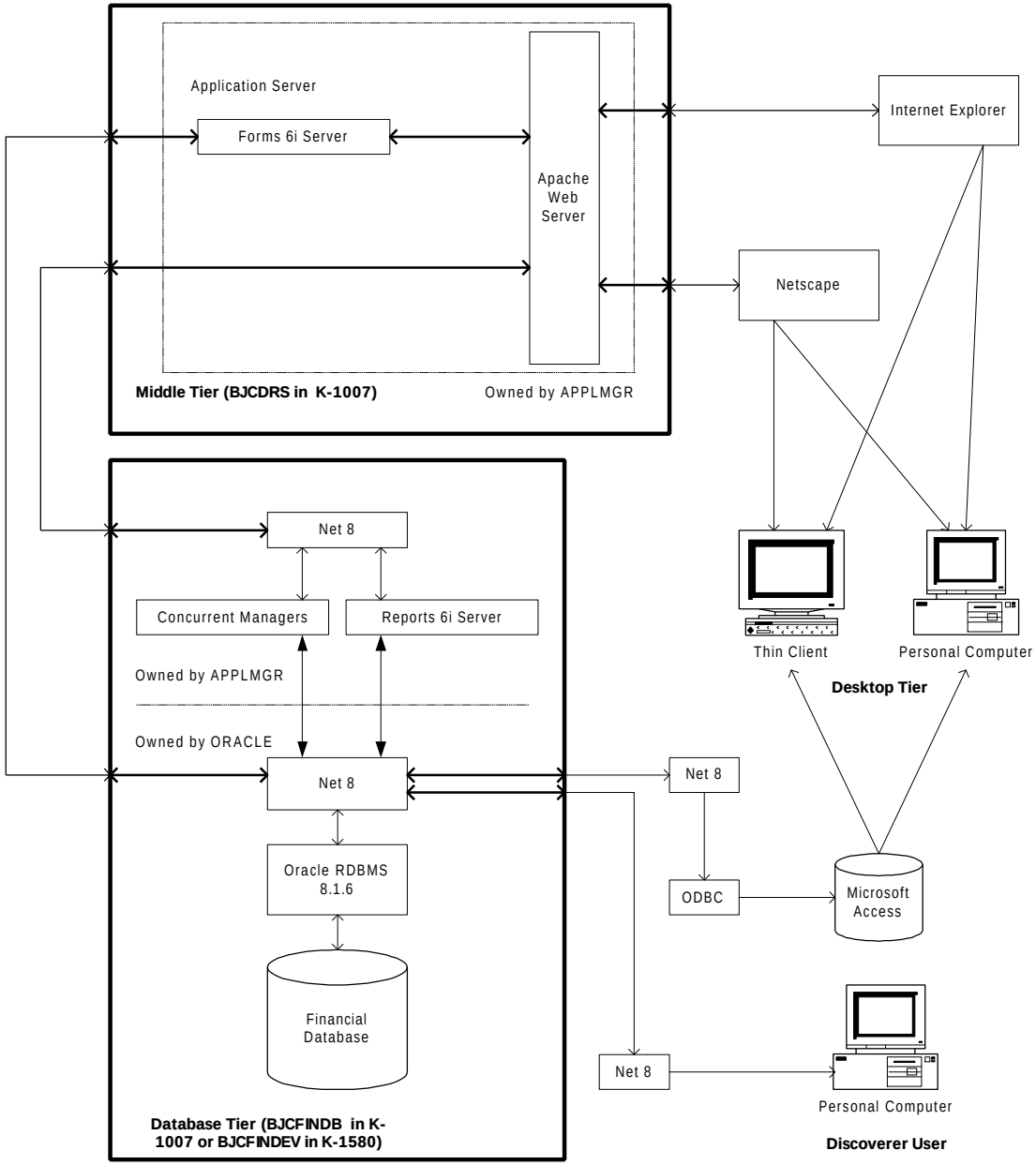
The Middle Tier of this architecture contains the Forms 6i server and the Apache Web server.

The Database Tier contains the Concurrent Managers, Reports 6i server, Net 8, Oracle RDBMS, and the Financials Database.

Bechtel Jacobs Financial Systems Physical Architecture
08/14/2001



Bechtel Jacobs Financial Systems Architecture
08/14/2001



6.1.1 Storage requirements and database backup processing

The minimum storage requirements for the Oracle database and Oracle Financial Server Configuration consist of approximately 60 GB of software and data. Some of the configuration file structures are not specific to an instance but would be utilized by all instances.

The minimum storage requirements for the mid-tier server are approximately 15 GB. Some of the configuration file structures are not specific to an instance but would be utilized by all instances.

A nightly hot backup will be done and a cold backup with export will be done on a weekly basis.

6.1.2 Software requirements and configuration control processing

The bulk of Financials is commercial off-the-shelf (COTS) software and it rarely changes. Any patches supplied by Oracle are always applied and evaluated in Test before being applied in Production. The Configuration Control process applies only to the custom portions of Oracle Financials.

Configuration control for Oracle Financials is accomplished via a set of software tools that provide for checkout and check-in of scripts and programs. A database is automatically maintained for the entire checkout / check-in history showing program name, date/time, by whom, etc. In addition, a change history is maintained in the form of archival copies of every program changed. Change requests are made and responded to electronically.

The custom software could be restored to the BJCFINDEV machine from the nightly or weekly application system backups made on BJCFINDB.

6.1.3 Hardware architecture

The Physical Architecture for the BJC Financial Systems as of 10/01/2001 (anticipated configuration) consists of three machines. There is a production database machine, a development/test machine, and a middle tier machine that serves as the middle tier for both the Production and Development database machines.

The production database tier BJCFINDB has two instances GOVT and CORP. The Reports 6i Server and Concurrent Managers are also housed on this machine under each instance. This machine is located in K-1007.

The development/test database tier BJCFINDEV has two instances DEVL and UPGD3. The Reports 6i Server and Concurrent Managers are also housed on this machine under each instance. This machine is located in K-1580.

The middle tier machine BJCDRS houses both the Apache WEB server and Oracle Forms server. This machine serves as the middle tier for both the production and devl/test databases. BJCDRS is located in K-1007.

Table 3 - Oracle Database and Financials Server Configuration - BJCFINDB

File System	Size	Type	Description
/db01 & db02	1-2 GB	RAID 0 + 1	DB *.ctl and *.log files
/db03 & db04	30-36 GB each	RAID 0 + 1	Database files (all)
/db60 (/db63,/db64)	36 GB	RAID 1	Backup db: (1 per inst.)
/db61	10-12 GB		Export: Full db export
/db62	8-16 GB	RAID 1	Arch: redo logs (7 days)
/db65	9-18 GB	RAID 2	Special Backups
/db69	2-5 GB	RAID 1	Fin prog log (60 days)
/oracle	13-18 GB per inst	RAID 1	Oracle db & Fin Apps
/oraclecd	10GB	No RAID	Staging for CD
/u00	2-4 GB	RAID 4	$HOME for users

Table 4 - Oracle Middle Tier Server Configuration

Number	Size	Type	Description
One	9 GB partition	RAID 0 + 1	For Patch Files
One	10 GB partition	RAID 0 + 1	CD Staging
One	2 GB partition	RAID 0 + 1	Tmp area
Four	18 GB partitions	RAID 0 + 1	For Web Servers

6.1.4 Interface requirements

Oracle Financials receives input from the following application systems:

- **Accruals Management** - This affects fee, but fee would not be a primary concern during a disaster situation. We could use the previous month's data or create a work-around.
- **CYBORG** - This input is critical and would need to be re-established. This data is pushed from Cyborg to the FIN XFER directory.
- **Government Transfers** - This input is critical. It includes files that are pulled from Y-12 and ORNL to the P:\ drive.
- **PARIS** - We could go ahead and pay the bills, continue to accumulate PARIS transactions, and distribute the costs when Oracle Financials is back in production.
- **PMCP** - Valid resources from PMCP are used within Oracle Financials for data validation tests. This ensures that only valid data is sent to PMCP. The alternative is no validation. This would not cause critical problems.
- **POOLS** - We could use last month's data or run from a PC.
- **PRISM** - This is not a critical input since there is little depreciation value remaining.
- **Service Centers** - We could use last month's data or run from a PC.
- **Suspense** - This input is not critical. This is a stand-alone application.

After Oracle Financials is running in a disaster recovery mode, all outputs can be produced and

inputs from Oracle Financials will have to be addressed by the disaster plans for these other applications.

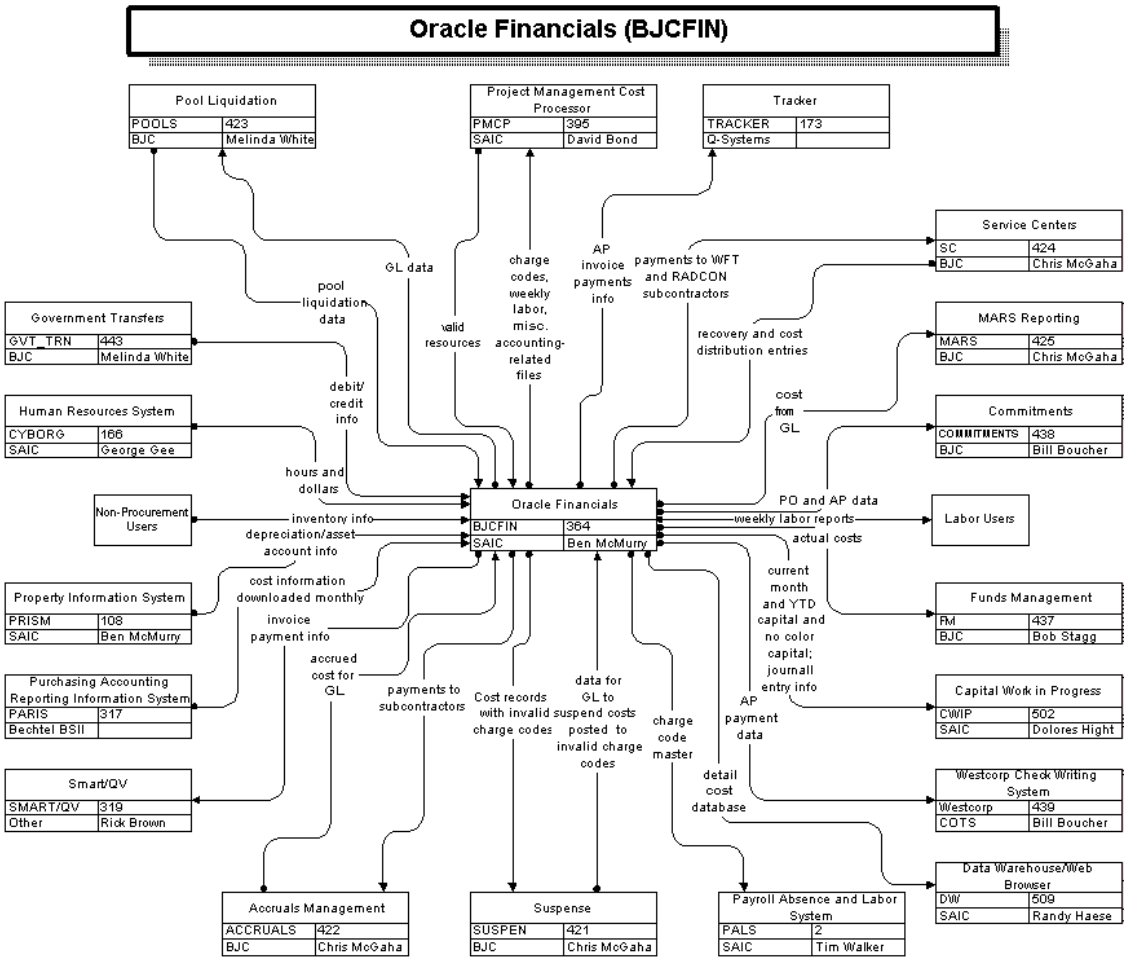


Figure 7 - Oracle Financials Interfaces

6.2 Describe business processing requirements

6.2.1 Functional Considerations

The time of the month of the failure/disaster will play a part in determining the type of action necessary to restore operability. The users' tolerance for downtime is directly related to the timing:

- Acceptable application system outage duration between last day of month and 3rd workday of following month: 3-4 hours.
- Acceptable application system outage duration last week of month up to last day of month: 24 hours.
- Acceptable application system outage duration between 4th workday and last week of the month: 48 hours.

The most critical output for the application system is the transmittal of the MARS data to DOE. This data has to be transferred by close of business on the 3rd Business Calendar workday of the month.

6.2.2 Technical Considerations

Access to the system's critical inputs will be required for running Financials. Cyborg's disaster plan should require the capability to transfer Oracle Financials input to the FIN XFER area on the BJCFINDEV machine in K-1580. Access to the Y-12 and ORNL computers will be necessary to pull the Government Transfers data.

6.3 Describe disaster mitigation strategies

The following assumptions for the Oracle Financials application DRP have been made:

- A trial test run of the disaster plan will be executed.
- Recovery for a disaster will be done for the GOVT books only.

The following actions will be taken in advance to prepare the Oracle Financial application for a disaster situation:

- Move the BJCFINDEV machine to K-1580.
- Procure and install the additional disk space/controllers needed for the BJCFINDEV server.
- Setup a standby production database on BJCFINDEV that receives regular update transactions from the GOVT production database on BJCFINDB.
- Setup the standby, production application software environment on BJCFINDEV.
- Setup a server (BJCNTDB3) in K-1580 to emulate the "P drive" in K-1007.
- Setup access or an access plan for an Oracle registered printer in K-1580. This will include the use of one of the network printers in K-1580 or a plan for connecting to and using the Westcorp printer in K-1580. The connection of the Westcorp printer to the network would only happen in the event of an actual emergency.
- Test bringing up production on the BJCFINDEV server.

6.3.1 Oracle Financials Application Server (BJCDRS in K-1007) down

In this situation the Oracle Financials application cannot be executed and therefore the following steps will be required for handling server failure:

- Systems personnel will evaluate the cause of the failure and the estimated time needed to bring the application system back online.
- If the estimated down time extends beyond the tolerable limits, disaster recovery procedures would be initiated.
- If the estimated down time falls within tolerable limits then wait for the server to be brought back up.

Disaster recovery procedures would involve using the application server software on BJCFINDEV in conjunction with the production database on BJCFINDB. Assume that all of the interface systems are accessible.

6.3.2 Oracle Financials Database Server (BJCFINDB in K-1007) down

In this situation the Oracle Financials application cannot be executed and therefore the following steps will be required for handling server failure:

- Systems personnel will evaluate the cause of the failure and the estimated time needed to bring the application system back online.
- If the estimated down time extends beyond the tolerable limits, disaster recovery procedures would be initiated.
- If the estimated down time falls within tolerable limits then wait for the server to be brought back up.

Disaster recovery procedures would involve using the standby database on BJCFINDEV as the production database. The only loss of data would be data on BJCFINDB that had not been transferred to the standby database on BJCFINDEV. The impact of this data loss should be minimal, since the data will be transferred to the standby on a regular schedule. Assume that all of the interface systems are accessible.

6.3.3 Some other application system that the Oracle Financials application interfaces with is down

Most of the other application systems are non critical and Financials could be run using older data.

If the "P" drive becomes unavailable NT support should be able to bring this drive back online quickly.

The Cyborg and Government Transfers systems are both critical inputs; if they are not functioning the following steps will be required:

- Determine length of anticipated outage.
- If the outage falls within the tolerance levels, then wait for the application systems to

disaster recovery plan. Government Transfers may be accessible from tape but it is not certain that the application systems providing this data have a disaster plan.

6.3.4 All of the K-1007 Machine Room is Unavailable

This is a combination of the previous scenarios. The Oracle Financials application and database servers are both down for what could be an extended period of time. Many of the interfacing systems may also be down. In this situation the Oracle Financials application cannot be executed and therefore the following steps will be required for handling server failure:

- The standby production environment on BJCFINDEV machine would become production.
- Data lost while awaiting transfer to the standby database on BJCFINDEV would have to be recovered.

The outage of interfacing systems will probably necessitate the use of previous month's data or data that the users stored on their PCs. Cyborg and Government Transfers will be accessed through those application systems' backup/disaster recovery procedures.

6.4 Describe minimal network, storage, hardware, software and interface requirements for each disaster scenario

Each scenario would require a machine name change and perhaps IP reconfigurations to allow the clients to communicate with the middle tier server and the middle tier server to communicate with the applications and data base server.

There would not be any additional storage, hardware, or software required for any of the disaster scenarios.

The minimal network and interface requirements would consist of access to the Cyborg and Government Transfer data. Depending on the nature of the disaster, this may involve access through those systems' disaster recovery procedures.

6.5 Describe K-1580 upgrades needed to support disaster-related Oracle Financials processing

No K-1580 upgrades are needed to support disaster-related Oracle Financials processing.

6.6 Describe process to re-host application in K-1580 and resume processing

- Make necessary machine name changes and IP reconfigurations.
- Perform any software reconfigurations needed for Rapid Install.

6.7 Describe process to return application processing to K-1007 following the disaster

Software. Other disasters could be less severe which would not require this step. At a minimum, the data would have to be loaded to the machine in K-1007 from backup tape from the temporary production machine in K-1580 and any networking changes that were performed at disaster time would need to be reversed.

6.8 Describe effort requirements for each disaster scenario

The only cost to re-host the application in K-1580 would be the labor hours to perform the reconfigurations – approximately 4 hours. The minimum cost for returning the application to K-1007 following the disaster would be the labor hours for recovering data from backup tape and making necessary reconfigurations to restore network connections – estimated hours 8-16. If the disaster has caused hardware damage, costs to restore service would rise dramatically.

7 Disaster plan for Cyborg/ACH

7.1 Describe production requirements

The Cyborg application is needed to meet requirements of the Internal Revenue Service regulations and other financial obligations and reporting requirements such as laws governing the deposit of Federal Income tax payments and proper handling of 401K Savings Plan deductions.

The Cyborg and ACH applications must remain operational for BJC to perform its mission and to meet federal and state reporting requirements.

Outage on payroll run days (Monday and Tuesday) require immediate response to assure timely issuance of payments to employees and deposit of tax monies. The absolute deadline for transmission of the ACH file is 6:00 P.M. every Tuesday. Manual checks could be produced as an alternative to the ACH transmission. Outages on other days may not require immediate action.

The essential functions of Cyborg include:

- Calculation of Payroll and Retiree Pension payments
- Calculation of required withholdings (Taxes, FICA, OASDI)
- Calculation of discretionary authorized withholdings (Savings Plans, United Way, Savings Bonds, etc.)
- Creation of tax reports, payment history, period-to-date dollars records, and positive pay records
- Creation of paychecks and Automated Clearing House (ACH) records for transmission to the banks
- Processing and support for Human Resources

7.1.1 Storage requirements and database backup processing

The BJCCYBORGDEV server is identical to BJCCYBORG in storage and system and application software (Refer to Hardware Architecture in 7.1.3 for details).

Table 5- BJCCYBORG & BJCCYBORGDEV Database Backup Schedule

Monday through Thursday	Daily incremental backup
Friday	Weekly/Monthly backup
Saturday and Sunday	If work is performed on the weekend, coordination with NT Support, Database Support and Computer Operations is required to ensure that an application system and database backup is performed at the close of each day.

In addition to the routine Oracle database backup, all database files are copied to the BJCCYBORGDEV server nightly.

7.1.2 Software requirements and configuration control processing

The minimum software requirements for the Cyborg application are:

- Microsoft Windows NT Server software, version 4.0 with service pack 6a
- Cyborg, version 4.5
- Microsoft Visual C++, version 6.0
- MERANT Micro Focus NetExpress, version 3.1.11
- Microsoft Visual SourceSafe
- SysAdmiral
- Oracle 8.1.7

The Configuration Control Procedure is described in the document "Bechtel Jacobs Configuration Process Procedure For the NT machine 'CONFIGURATION CONTROL IMPLEMENTATION'" dated February 9, 2001.

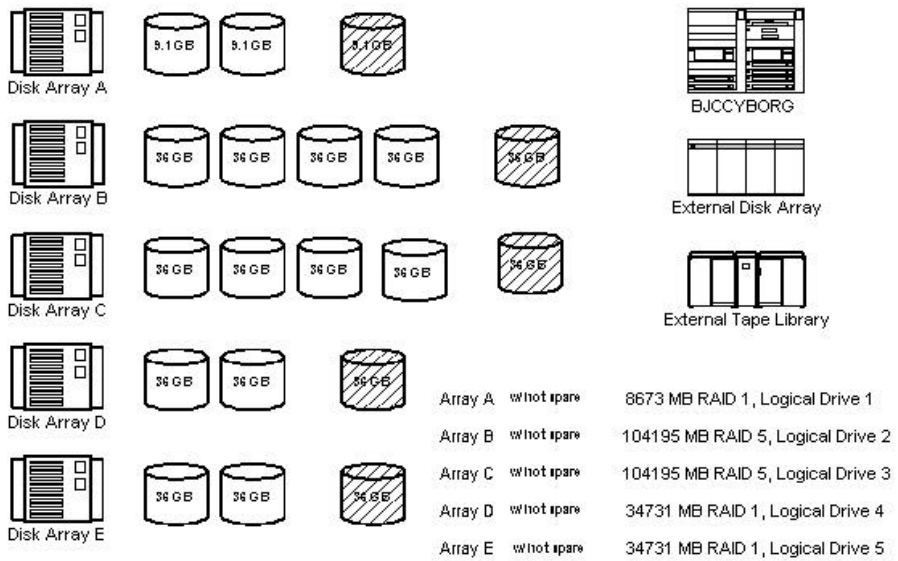
Configuration control for Cyborg scripts, delivered and custom software is accomplished via Microsoft Visual SourceSafe (VSS). VSS is a set of software tools that provide for version control, history services, check-in, and checkout of custom and vendor supplied software, to ensure that each version of a file is recoverable.

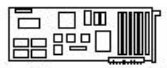
Cyborg Configuration Control procedures and forms are located on the BJCHRNT server. Hard copies are kept in room 3081 in 151 Lafayette Road.

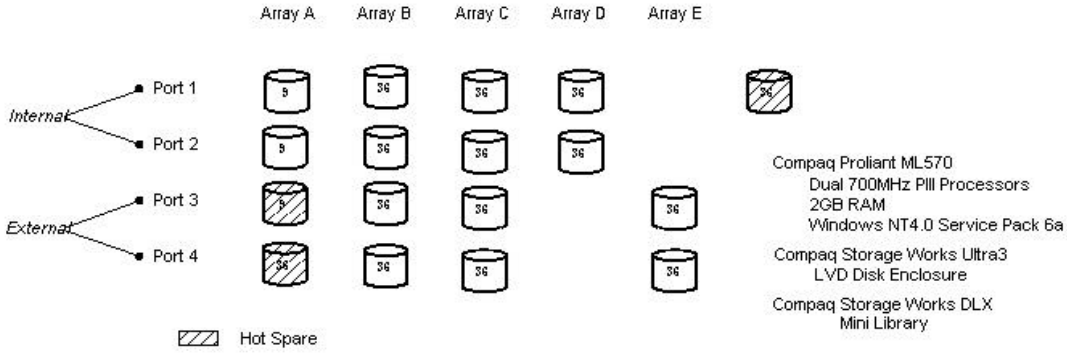
7.1.3 Hardware architecture

The physical architecture for the BJC Cyborg application system is one NT server (BJCCYBORG). This server is located in the machine room at K-1007. The Cyborg development and disaster recovery server (BJCCYBORGDEV), located in K-1580, is identical in hardware configuration to BJCCYBORG.

BJCCYBORG Hardware Architectural Overview







Drive C:	RAID1 - 4GB usable drive space, 1.5GB available drive space
Drive D:	CDROM
Drive E:	RAID5 - 101GB usable drive space
Drive F:	RAID5 - 101GB usable drive space
Drive G:	RAID1 - 33.9GB usable drive space

7.1.4 Interface requirements

Cyborg receives input from the following application systems:

- **PALS – Labor and absence data.** The PALS interface will be available during an outage. PALS will provide labor and absence data to Cyborg.
- **GLI-NES - Employee name and address updates.** If the GLI-NES interface is not available, employee name and address changes can be entered directly in Cyborg. When GLI-NES interface is available, all GLI-NES changes during the outage will be included.
- **K-TRANS - Benefit deduction transactions.** If the K-TRANS interface is not available, K-TRANS data can be submitted from the IT Support personnel PC located at 151 Lafayette Road.

Cyborg provides data to the following application systems:

- JP Morgan (savings plan) files
- Oracle Financials – hours and dollars
- Online report files generated in the payroll run
- Microfiche data files
- ACH (direct deposit) transmission files
- Check Reconciliation /Positive Pay files
- PALS eligibility data file
- Employee data for downstream processing
- Employee Saving Bond purchases
- Pension Actuarial
- Insurance Eligibility
- Employee Flexible Spending Accounts files
- United Way contribution campaign
- General Employee data to BJCPROD1
- Social Security Withholdings
- Employee W-2 data
- Westcorp Check file

NOTE: Adjustments may be required for missing 401K submissions.

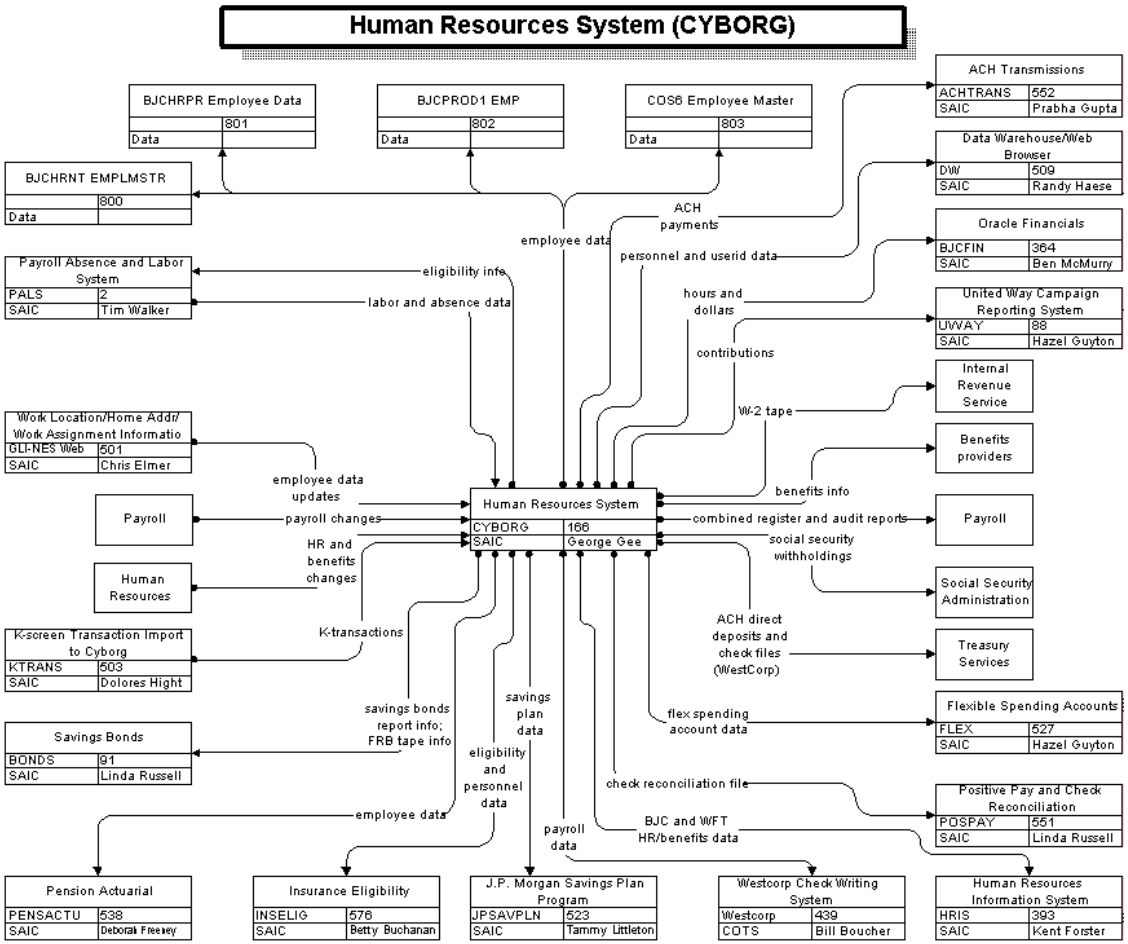


Figure 9 - Human Resources System (CYBORG) Interfaces

7.2 Describe business processing requirements

7.2.1 Functional Considerations

The Cyborg application must remain operational for BJC to perform its mission and to meet requirements of the Internal Revenue regulation and other financial obligations/reporting.

The day of the week when the failure/disaster occurs will determine the type of action required to restore operability. Outage on payroll run days (Monday and Tuesday) require immediate response to assure timely issuance of payments to employees and deposit of tax monies. Outages on other days may not require immediate action.

Long-term outage as defined by the customers will require re-hosting the production application to the BYCCYBORGDEV and redirecting the CFO and HR Cyborg users to the disaster recovery server.

The following points apply during disaster recovery:

- A year-end outage would be the worst case.
- HR processing can be out for the short term.
- HR staff will need to work closely with Payroll to process deductions
- Close coordination between HR and CFO is required to ensure successful payroll processing during outage.
- K-Trans can be used to automate deductions.
- If the automated feed to benefits plan carriers is missed, manual changes can be sent.
- Standard deductions during the outage can be used while manually tracking and reconciling discrepancies following the outage.
- Turn off terminations and tear up checks for terminated employees during the outage.

7.2.2 Technical Considerations

Availability of Personnel - Personnel from the following organizations must be available to provide assistance during disaster recovery execution:

- BJC CFO
- BJC HR
- BJC IT
- IT Support
- IT Database Support
- IT NT Support
- Computer Operations

UCAMS - All Cyborg production accounts must be established on BJCCYBORGDEV

Router Access - All Cyborg user IP addresses must be added to the router for

7.3 Describe disaster mitigation strategies

The following assumptions for the Cyborg application DRP have been made:

- Daily operating system (including database) backup tapes are available.
- All Cyborg interface application servers (BJCPROD1, BJCHRNT, BJCFINDB, check writing PC) are available or have alternate means of sending and receiving data.
- In the event of an outage during year-end processing, special consideration will be required as directed by CFO and HR.

The following actions will be taken to prepare the Cyborg application for a disaster situation:

- Cyborg production data will be copied to BJCCYBORGDEV daily.
- P20in file will be created and copied to BJCCYBORGDEV daily.
- Cyborg Oracle database data will be copied to BJCCYBORGDEV daily.
- Disaster recovery test plan will be executed yearly.
- Software and user manuals will be kept in hardcopy and electronic form in separate locations.

7.4 Describe minimal network, storage, hardware, software and interface requirements for each disaster scenario

The Cyborg development and disaster recover server (BJCCYBORGDEV) is identical in hardware configuration to BJCCYBORG (Refer to Hardware Architecture in 7.1.3 for details). Additional hardware is not anticipated to be needed to process a batch payroll.

The BJCCYBORGDEV has identical software as BJCCYBORG. Additional software is not anticipated to be needed to process a batch payroll.

BJCCYBORGDEV is an equivalent processor to BJCCYBORG with disk space available for payroll processing.

7.5 Describe K-1580 upgrades needed to support disaster-related Cyborg/ACH processing

No K-1580 upgrades are needed to support Cyborg disaster recovery processing.

7.6 Describe process to re-host application in K-1580 and resume processing

7.6.1 Procedures to host the production application on BJCCYBORGDEV

The following steps will be executed to move the Cyborg production application to BJCCYBORDEV in the event the Cyborg server becomes unavailable or the machine room at K-1007 is lost:

- Verify the latest date of P20in.mrg on BJCCYBORGDEV.
- Initiate Pay merge using P20 to populate the Cyborg index files and Oracle database.
- Check for successful completion.
- Notify Users of the availability of Production Cyborg with applicable instructions to access the Cyborg application on the BJCCYBORGDEV server.

If payroll run day, execute the following steps to run payroll:

- Enter data into Cyborg (CFO and HR).
- Enter appropriated data for payroll setting in AE and AJ screens.
- Identify source of PALS data and transfer to appropriate area on BJCCYBORGDEV.
- Verify that all online scripts are functioning properly and data is readable.
- Generate Health of System reports.
- Start the pay run via the payroll scripts.
- Identify all system interface requirements and provide data to their identified platform.

If the outage is expected to last for a longer duration, each Cyborg user's application will be redirected to the BJCCYBORGDEV.

If the server becomes unavailable during regular business hours, the functional organizations must re-enter data into Cyborg once the application is available on BJCCYBORGDEV. A maximum of one day's data may be lost.

7.6.2 Alternate process to provide ACH file

The following steps will be executed to provide for timely submission of ACH data in the event normal transfer methods are not available:

- Copy the ACH file to diskette
- Provide diskette to CFO representative

7.7 Describe process to return application processing to K-1007 following the disaster

The following procedures will be performed to restart application on BJCCYBORG:

- Execute a pay extract to create a P20in.mrg file on BJCCYBORGDEV.
- Copy P20in.mrg to BJCCYBORG.
- Initiate Pay merge.

7.8 Describe effort requirements for each disaster scenario

The cost to re-host the application in K-1580 would be the labor hours to perform the steps in 7.6. Estimated time to re-host the Cyborg application to BJCCYBORGDEV is 4 hours.

The cost to return Cyborg to BJCCYBORG would be the labor hours to perform the steps in 7.7. Estimated time to return Cyborg to BJCCYBORG is 10 hours.

8 Disaster plan for Westcorp

Westcorp is a commercial software package used to print manual Payroll and Accounts Payable checks.

8.1 Describe production requirements

8.1.1 Storage requirements and database backup processing

N/A

8.1.2 Software requirements and configuration control processing

Westcorp is a commercial off-the-shelf package. No add-on code or modifications have been used for this package. No configuration control is necessary.

8.1.3 Hardware architecture

A stand-alone PC and printer in K-1007 is used to run Westcorp. For security reasons, this PC has very limited network access. A special Magnetic Ink Character Recognition (MICR) toner cartridge is used to allow financial institutions to read the checks.

8.1.4 Interface requirements

Westcorp receives input from the following application systems:

- A file of payroll data from Cyborg to produce manual payroll checks and check stubs for employees with direct deposit. The majority of payroll checks are transmitted to the Automated Clearing House for direct deposit. This file is sent using the file transfer protocol (FTP) to the Westcorp PC for processing and check production.

- A file of Accounts Payable payment data from Oracle Financials. This file is sent from Oracle Financials via e-mail to CFO staff. Then the file is copied to a diskette and carried to the Westcorp PC for processing and check production.

Westcorp produces the following output:

- The paper checks produced by Westcorp are given to Treasury Services staff to be distributed.

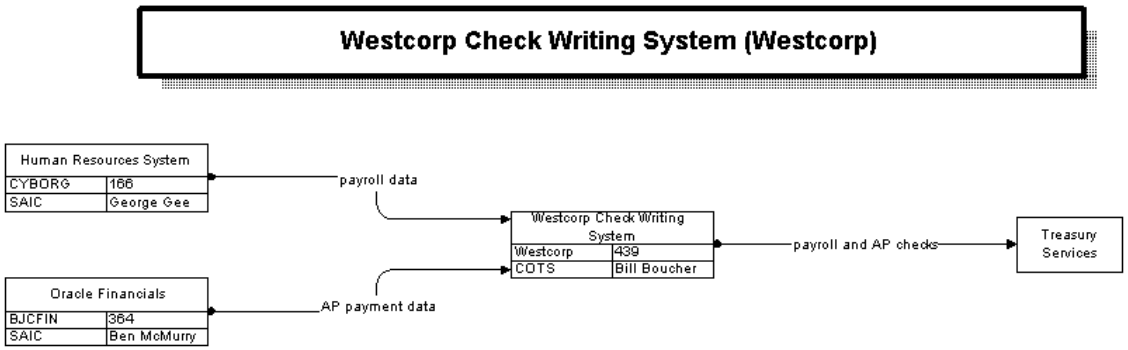


Figure 10 - Westcorp Check Writing System (Westcorp) Interfaces

8.2 Describe business processing requirements

8.2.1 Functional Considerations

None.

8.2.2 Technical Considerations

None.

8.3 Describe disaster mitigation strategies

None are needed.

8.4 Describe minimal network, storage, hardware, software and interface requirements for each disaster scenario

A disaster recovery PC equipped with the Westcorp software and a printer with the special toner cartridge have already been moved to K-1580. Adequate supplies, including at least two weeks ' worth of check stock for AP and payroll checks, are also in K-1580. The ability to print checks in K-1580 has already been tested.

8.5 Describe K-1580 upgrades needed to support disaster-related Westcorp processing

None.

8.6 Describe process to re-host application in K-1580 and resume processing

The K-1580 environment is identical to the production environment. CFO staff would just take their diskettes to K-1580 and resume processing.

8.7 Describe process to return application processing to K-1007 following the disaster

N/A

8.8 Describe effort requirements for each disaster scenario

Cost and schedule requirements for Westcorp are minimal.

APPENDIX A – ACRONYMS

A/C - Air Conditioning
ACH - Automated Clearing House
AP - Accounts Payable
BJC - Bechtel Jacobs Corporation LLC
CF - Cold Fusion
CFO - Chief Financial Officer
COTS - Commercial off-the-shelf
CYBORG – Commercial payroll/human resources system
DRP - Disaster Recovery Plan
EMP - Employee Master, Name of table containing employee information
GLI-NES - General Locator Information Non-Employee System
HR - Human Resources
IAL - Internal Access List
MICR - Magnetic Ink Character Recognition
NT – the Microsoft NT operating system
PALS – Payroll, Absence, and Labor System
UPS - Uninterruptible Power Supply
VSS - Visual SourceSafe